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IRRADIATION: ITS PHYSIOLOGY, PATHOLOGY, AND THERAPEUTICS.

Radium, X-Rays, and the Living Cell. With Physical Introduction. By H. A. Colwell and Dr. S. Russ. Pp. x+324. (London: G. Bell and Sons, Ltd., 1915.) Price 12*s.* 6*d.* net.

THE authors' object is "to describe some of the main experimental facts which have been established as to the effects of the X-rays and the rays from radium upon living cells." The first part of the book is devoted to physics, and contains a trustworthy account of the properties of the X-rays, primary and secondary, and of the radio-active substances, with the characters of the various forms of radiation and the changes brought about by their action. The measurement of ionisation is described, the distinction between "hard" and "soft" rays—recognised clinically by all radiologists—is explained on physical lines, and the methods of measuring doses of X-rays are discussed. The empirical method of Sabouraud of judging the dose by the change of colour of a pastille is still in vogue, and those who use the method are aware that they must keep all the conditions constant (state of vacuum of the tube, length of the parallel spark gap, reading of the milliamperemetre, etc.); the authors are wise, however, to point out anew that the same change of colour, if produced by soft rays in one case and by hard rays in another, may give rise to results widely different in the two cases.

In describing the characters of radium emanation, the use of the "Emanatoria" is discussed. These institutions are founded on the fact that radium emanation, when breathed mixed with air, gradually makes its way into the circulation by solution and diffusion, and so reaches all the tissues of the body. The air of the Emanatorium is breathed for two or three hours at a time, and it is found that a state of equilibrium is reached in half an hour, while nearly all the emanation (90 per cent.) has disappeared from the system one hour after removal into fresh air. The emanation, while circulating in the body, is continually forming the active deposit, which is not lost by way of the lungs as is the case with the emanation. These Emanatoria have been extolled for the "scientific" treatment of gout, on the principle (capable of laboratory demonstration) that the insoluble monosodium urate can be broken up by radium D into several simpler bodies, which are eliminated as carbon dioxide and ammonia. The authors point out, however, that the concentration of the emanation in the blood in patients subjected to Emanatorium treatment never reaches more than one ten-millionth of that used in the laboratory experiments; hence it seems unlikely that any appreciable decomposition of monosodium urate can take place in the blood.

Globulin solutions are used in experiments to show that α radiation may produce results differing in degree and in kind from those due to β and γ rays.

The effects of the irradiation of bacteria is discussed with the aid of conclusive experiments, and it is shown that a bactericidal result can be attained, though the dose required is a very strong one from a clinical point of view. In local conditions a solution of radium emanation might be useful, but the choice of a solvent is important, and most of the fluids having high coefficients of absorption cannot be used for injection into the body. Liquid paraffin is the most suitable solvent; its coefficient of absorption is high, and its viscosity keeps it at the site of injection.

The changes produced in the skin by irradiation are only too well known to those who were pioneers in the clinical use of the X-rays. The histological changes are described in detail, and illustrated by photomicrographs. These changes are both atrophic and hypertrophic, and the latter tend to culminate in cancer.

The blood changes are of great interest, and in certain blood diseases a very favourable result is produced by irradiation. This is notably true of leukæmia, a disease in which the white cells are enormously increased in number, while many of them are abnormal in type. The red cells are decreased in number. The result of X-ray treatment is to restore the blood more and more nearly to a normal state, both qualitatively and quantitatively

Of special interest to the medical profession, and also to the public, is the discussion of the effect of irradiation of cancerous cells. This subject receives full attention, an account of the results on experimental cancers (*e.g.* in mice) being followed by a description of those on spontaneous cancers in man and in the lower animals. It is found that young, actively-dividing cancer cells are most susceptible to irradiation, and that in some of these cases (especially in the grafted cancers of mice), while a large tumour may disappear rapidly, its destruction may cause the death of the animal by the toxins evolved during the disintegration of the mass.

Another aspect of the cancer question is the converse one, of the way cancerous change may be produced in healthy tissues by repeated small doses of soft X-rays. This topic has been touched upon already in the case of the hands of radiologists.

The question of idiosyncrasy is a difficult one, and radiologists of repute differ, even now, as to whether cases of real hypersensitiveness to X-rays exist. Every careful radiologist of experience will, we believe, agree with the authors that the same dose does not produce exactly the same effect in different persons, or even in the same person at different times. Another point is made by the authors when they show that a large dose acting for a short time is not equivalent to a small dose acting for a long time.

The book closes with a short but lucid chapter on the selective and differential action of the rays. In the case of the protozoa, it is shown that a

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wide variation exists in their response to the same exposure. An absence of chlorophyll makes for increased sensitiveness, and the multi-nucleated forms suffer more than the mono-nucleated, and the large forms more than the small. In the testicle the rays show an essentially selective action, the seminiferous epithelium being destroyed by a dose to which the cells of Sertoli are indifferent. Certain tissues are highly sensitive to the X-rays—notably lymphoid tissue, cartilage, and the endothelium of blood-vessels. Within limits it is true to say that very rapidly growing cells are most affected by irradiation. But it is important to note that different rays give rise to different effects upon one and the same kind of cell, and "a careful distinction should be made between the differential action which different rays have upon the same variety of cell, and the selective action which the same kind of radiation has upon the many different varieties of cells." The X-ray spectrum covers a range of many octaves of wave-length.

If we consider a single cell, we find it exhibits a widely varying degree of reaction (to irradiation) according to the particular phase of its life cycle in which it happens to be at the time. Thus certain ova are nearly eight times as vulnerable to β-rays when they are in an active state of division as when they are in a resting stage. This fact indicates one of the difficulties of quantitative investigations upon living tissues. The chemical composition of a cell may determine the degree of change brought about by irradiation. In sections of malignant growths cut for the microscope before and after irradiation, the staining reactions point to marked changes in chemical composition, and these go hand in hand with the morphological changes.

The authors have given us a book which cannot fail to appeal to the clinical radiologist and to the laboratory worker. Each chapter has received careful study in the writing, and provides food for thought and suggests scope for further investigation on the part of the reader. The book is well printed in clear type on good paper, and contains many excellent illustrations. There is an index of authors, as well as a full general index.

THE MEDIUM UNDER THE MICROSCOPE

A Contribution to the Study of the Psychology of Mrs. Piper's Trance Phenomena. By Mrs. Henry Sidgwick. *Proceedings of the Society for Psychical Research.* Part lxxi., vol. xxviii, December, 1915. Pp. xix + 657. (Glasgow: R. Maclehose and Co., Ltd., 1915) Price 12*s.* net.

WILLIAM JAMES once referred to Henry Sidgwick as "the most exasperatingly critical mind in England," and the whimsical compliment was well deserved. After the death of the famous professor of moral philosophy, the mantle of the arch-critic fell naturally on the shoulders of one of Sidgwick's most able pupils, Mr. A. J. Balfour, whose "Defence of Philosophic Doubt" was as destructive as we hope our Navy will be under his First Lordship; but now that he has reached a more constructive period, as evidenced by his recent "Theism and Humanism," the pallium passes to his sister, the professor's widow, and late principal of Newnham College. Anyone who is not willing to believe unquestioningly what has successfully passed the ordeal of her scrutiny must be constitutionally unable to believe anything. If she were censor the newspapers would have to cease publication, for she would never believe any but official reports, and probably not them.

In this bulky volume Mrs. Sidgwick discusses the phenomena of the famous Boston medium who has been for twenty-five years almost continuously under the supervision of various eminent scientific men, including Prof. James—who was an M.D. as well as the apostle of Pragmatism—and Sir Oliver Lodge. This lady began to experience sleep-like trances in 1884, but they were only sleep-like so far as concerned Mrs. Piper's normal consciousness, for her tongue talked—or, later, her hand wrote—in a very wideawake fashion. What was there, in place of Mrs. Piper's normal consciousness, which certainly was *not* there, furnishes the theme of Mrs. Sidgwick's discourse. First, ostensibly, came a Dr. Phinuit, a "spirit" who said he had been a doctor in Metz. Investigation failed to trace his earthly career, and his knowledge of French was scanty—seemed, in fact, about like Mrs. Piper's. But the queer thing was that this dubious entity could usually tell sitters quite a lot about their deceased relatives, and he professed to get the information from the relatives themselves, who were with him in the spiritual realms. This kind of thing happened freely, even when the investigators introduced sitters from a distance—people entirely unknown to Mrs. Piper—anonymously or pseudonymously. Then another spirit turned up—George Pelham, a lawyer formerly known to the Society's chief investigator, Dr. Richard Hodgson—who gave any amount of identification evidence about himself, recognising his friends and greeting them by name in astonishingly correct fashion. Later there appeared various characters in early history. Lastly came Hodgson, who had died in 1905; but his evidence is not very weighty, because he was known to Mrs. Piper, and consequently we must assume that any given would-be identification-fact may also have been known to her.

Now what about all these "controls" and "communicators"? What are they, anyhow? Spirits, as they allege, or dream-personalities, fragments of Mrs. Piper's subliminal or hypnotic consciousness? Mrs. Sidgwick thinks the latter; and most people will agree with her rather than weigh all her arguments, which are lengthy and complicated, though the historical part of the book is easy and interesting. She admits, however, that Mrs. Piper's trance utterances contain a great deal of matter which Mrs. Piper has not learnt through the known sensory channels. This dis-

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